WHAT IS CLAIMED IS

1. A plastic optical element producing method for producing a plastic optical element by an ejection molding which uses a mold having a cavity of a predetermined volume and at least one transfer surface formed in a cavity surface which defines the cavity, injects a melted resin material into the mold and transfers the transfer surface which forms an optical surface of the plastic optical element by a resin pressure generated within the cavity, and removes the plastic optical element from the mold to be naturally cooled, comprising the step of:

(a) cooling the optical surface of the plastic optical element with priority in a state where a temperature of the plastic optical element is within a predetermined temperature range which is less than or equal to a glass transition temperature of the resin material.

2. The plastic optical element producing method as claimed in claim 1, further comprising the step of:

(b) annealing at least a portion of a surface of the plastic optical element other than the optical surface.

3. The plastic optical element producing method as claimed in claim 1, further comprising the step of:

(b) annealing at least a portion of a surface of the plastic optical element other than the optical surface via a temperature control member.

4. The plastic optical element producing method as claimed in claim 3, wherein said step (b) arranges a plurality of plastic optical elements side by side by contacting respective surfaces other than the optical surface, and contacts a surface other than the

optical surface of each plastic optical element arranged at an outermost position to the temperature control member.

5. The plastic optical element producing method as claimed in claim 3, wherein said step (b) uses a temperature control member having heating means.

6. The plastic optical element producing method as claimed in claim 5, wherein said step (b) uses a non-contacting heating apparatus as the heating means.

7. The plastic optical element producing method as claimed in claim 6, wherein said step (b) uses an infrared ray heating apparatus or a high-frequency heating apparatus as the non-contacting heating

apparatus.

8. The plastic optical element producing method as claimed in claim 1, wherein said step (a) cools the optical surface of the plastic optical element.

9. The plastic optical element producing method as claimed in claim 1, further comprising the step of:

(b) annealing the optical surface of the plastic optical element via a temperature control member.

10. The plastic optical element producing method as claimed in claim 9, further comprising the step of:

(c) controlling a temperature of the temperature

control member depending on a surrounding temperature.

11. The plastic optical element producing method as claimed in claim 3, further comprising the step of:

(c) controlling a temperature of the temperature control member depending on a surrounding temperature.

12. The plastic optical element producing method as claimed in claim 2, wherein said step (b) carries out an annealing at a rate of 3℃ per minute or less.

13. The plastic optical element producing method as claimed in claim 1, wherein a lower limit value of the predetermined temperature range is [GTT -

40℃], where GTT denotes a glass transition temperature of the resin material.

14. The plastic optical element producing method as claimed in claim 1, further comprising the step of:

(b) heating the plastic optical element which has a temperature lower the predetermined temperature range up to a temperature within the predetermined temperature range before carrying out an annealing with respect to the plastic optical element.

15. The plastic optical element producing method as claimed in claim 14, wherein said step (b) maintains the temperature of the plastic optical element within the predetermined temperature range until the annealing is started.

16. The plastic optical element producing method as claimed in claim 1, further comprising the step of:

(b) cooling the plastic optical element which has a temperature higher the predetermined temperature range down to a temperature within the predetermined temperature range before carrying out an annealing with respect to the plastic optical element.

17. The plastic optical element producing method as claimed in claim 16, wherein said step (b) maintains the temperature of the plastic optical element within the predetermined temperature range until the annealing is started.

18. A plastic optical element producing apparatus for producing a plastic optical element by an ejection molding which uses a mold having a cavity of a predetermined volume and at least one transfer surface

formed in a cavity surface which defines the cavity, injects a melted resin material into the mold and transfers the transfer surface which forms an optical surface of the plastic optical element by a resin pressure generated within the cavity, and removes the plastic optical element from the mold to be naturally cooled, comprising:

at least one temperature control member contacting at least a portion of a surface of the plastic optical element other than the optical surface to carry out an annealing with respect to the plastic optical element during a resin cooling process when a temperature of the plastic optical element falls within a predetermined temperature range lower than or equal to a glass transition temperature of the resin material.

19. The plastic optical element producing apparatus as claimed in claim 18, comprising a pair of temperature control members, wherein a plurality of plastic optical elements are arranged side by side by contacting respective surfaces other than the optical surface, and each of the pair of temperature control

members contacts a surface other than the optical surface of a corresponding one of the plastic optical elements arranged at an outermost position so that the plurality of plastic optical elements are sandwiched between the pair of temperature control members.

20. The plastic optical element producing apparatus as claimed in claim 18, wherein said temperature control member includes heating means.

21. The plastic optical element producing apparatus as claimed in claim 20, wherein said heating means includes a non-contacting heating apparatus.

22. The plastic optical element producing apparatus as claimed in claim 21, wherein said non-

contacting heating apparatus includes an infrared ray heating apparatus or a high-frequency heating apparatus.

23. A plastic optical element producing apparatus for producing a plastic optical element by an ejection molding which uses a mold having a cavity of a predetermined volume and at least one transfer surface formed in a cavity surface which defines the cavity, injects a melted resin material into the mold and transfers the transfer surface which forms an optical surface of the plastic optical element by a resin pressure generated within the cavity, and removes the plastic optical element from the mold to be naturally cooled, comprising:

at least one temperature control member contacting and cooling the optical surface of the plastic optical element during a resin cooling process when a temperature of the plastic optical element falls within a predetermined temperature range lower than or equal to a glass transition temperature of the resin material.

24. The plastic optical element producing apparatus as claimed in claim 18, wherein said temperature control member controls the temperature of the plastic optical element depending on a surrounding temperature.

25. The plastic optical element producing apparatus as claimed in claim 23, wherein said temperature control member controls the temperature of the plastic optical element depending on a surrounding temperature.

26. The plastic optical element producing apparatus as claimed in claim 18, further comprising:

means for annealing at least the portion of the surface of the plastic optical element other than the optical surface at a rate of 3℃ per minute or less.

27. The plastic optical element producing apparatus as claimed in claim 23, further comprising:

means for annealing at least a portion of a surface of the plastic optical element other than the optical surface at a rate of 3℃ per minute or less.

28. The plastic optical element producing apparatus as claimed in claim 18, comprising a plurality of temperature control members, wherein each of the plurality of temperature control members is used for an annealing until the annealing is completed within one cycle of the resin cooling process.

29. The plastic optical element producing apparatus as claimed in claim 18, wherein a lower limit value of the predetermined temperature range is [GTT - 40℃], where GTT denotes a glass transition temperature of the resin material.

30. The plastic optical element producing apparatus as claimed in claim 23, wherein a lower limit value of the predetermined temperature range is [GTT - 40℃], where GTT denotes a glass transition temperature of the resin material.

31. The plastic optical element producing apparatus as claimed in claim 18, further comprising:

means for heating the plastic optical element which has a temperature lower the predetermined temperature range up to a temperature within the predetermined temperature range before carrying out an annealing with respect to the plastic optical element.

32. The plastic optical element producing apparatus as claimed in claim 31, wherein said means maintains the temperature of the plastic optical element within the predetermined temperature range until the annealing is started.

33. The plastic optical element producing apparatus as claimed in claim 18, further comprising:

means for cooling the plastic optical element which has a temperature higher the predetermined temperature range down to a temperature within the predetermined temperature range before carrying out an annealing with respect to the plastic optical element.

34. The plastic optical element producing apparatus as claimed in claim 33, wherein said means maintains the temperature of the plastic optical element within the predetermined temperature range until the annealing is started.

35. A plastic optical element which is produced by an ejection molding which uses a mold having a cavity of a predetermined volume and at least one transfer surface formed in a cavity surface which defines the cavity, injects a melted resin material into

the mold and transfers the transfer surface which forms an optical surface of the plastic optical element by a resin pressure generated within the cavity, and removes the plastic optical element from the mold to be naturally cooled, wherein:

the optical surface of the plastic optical element is cooled with priority during a resin cooling process in a state where a temperature of the plastic optical element is within a predetermined temperature range which is less than or equal to a glass transition temperature of the resin material.

36. A plastic optical element which is produced by an ejection molding which uses a mold having a cavity of a predetermined volume and at least one transfer surface formed in a cavity surface which defines the cavity, injects a melted resin material into the mold and transfers the transfer surface which forms an optical surface of the plastic optical element by a resin pressure generated within the cavity, and removes the plastic optical element from the mold to be naturally cooled, wherein:

at least a portion of a surface of the plastic optical element other than the optical surface is contacted by at least one temperature control member to carry out an annealing with respect to the plastic optical element during a resin cooling process when a temperature of the plastic optical element falls within a predetermined temperature range lower than or equal to a glass transition temperature of the resin material.

37. A plastic optical element comprising:

an optical surface through which an incoming light is transmitted in a light transmitting direction; and

a side surface,

wherein a refractive index distribution is formed in the light transmitting direction.